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SHORT AND SWEET

Close, and a cigar!—Why size perception relates to performance

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Abstract. In baseball batting, golf putting, and dart throwing, successful players estimate the size of the target object to be bigger than their less successful counterparts. While more and more empirical evidence is accumulated supporting the existence of this intriguing phenomenon, an explanation of the processes underpinning this effect remains to be provided. Here, we re-analysed data from a dart throwing experiment to examine the proposal—recently put forward by Proffitt and Linkenauger (in press)—that the variability in target-related performance may serve as a scaling metric for perceived target size which may explain why actors who perform consistently close to the target perceive the target to be bigger. Our results confirm that less variability in target-related performance in darts relates to perceiving the target as being bigger, thereby providing initial support for Proffitt and Linkenauger's proposal.

Keywords: action, perception, skill, sport

Baseball players who hit more often estimate the ball to be bigger than less successful baseball players (Witt and Proffitt 2005). The same phenomenon has been shown in golf (Cañal-Bruland et al 2011; Witt et al 2008), American football (Witt and Dorsch 2009), and dart throwing (Cañal-Bruland et al 2010; Wesp et al 2004). While more and more evidence is being accumulated to support the existence of this phenomenon, dubbed action-specific perception (Witt 2011; see also Cañal-Bruland and van der Kamp 2009), the processes underpinning the occurrence of this performance-related perceptual bias remain to be determined.

An interesting proposal why more successful players may perceive the target (ie the hole, goal, bull's eye, etc) to be bigger has recently been put forward by Dennis Proffitt and Sally Linkenauger (in press). They argue that skilled performance can be best described as consistently successful performance of a specific skill. Such behaviour is reflected in the variability of one's movement outcomes. That is, more consistency in the successful performance of a dart throw, for example, aiming at the bull's eye results in a smaller distribution of the darts' landing locations around the bull's eye, whereas less skilled performance results in a larger distribution of the darts' landing locations. Following this line of reasoning, Proffitt and Linkenauger submit that the variability in target-related performance may serve as a scaling metric for perceived target size, which in turn may explain why actors who show more consistent target-related performances perceive the target as being bigger (for an illustration of the idea, see figure 1).

To examine this hypothesis, in this paper we re-analysed data from a dart throwing study in which we originally examined the influence of anxiety on action-specific perception (Cañal-Bruland et al 2010). In that particular paper, we invited thirty participants to throw darts at a circle-shaped target and to estimate the size of the target. As a within-subject-manipulation participants had to perform 24 throws both in a low anxiety and high-anxiety condition (ie low and high on a climbing wall, respectively). Our results revealed a negative correlation between the mean radial errors of the darts' landing locations and the size estimates of the target in the low anxiety condition. In other words, target-related performance was positively correlated with size perception of the target.

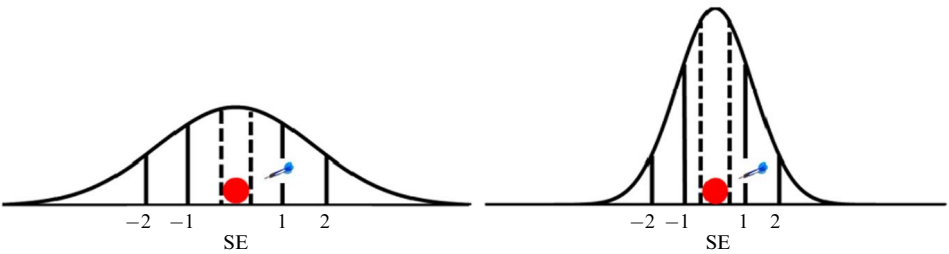

Figure 1. [In colour online, see http://dx.doi.org/10.1068/p7255] Dart distributions as a scaling metric for perceived target size (adapted from Proffitt and Linkenauger, in press).

In the original experiment, we measured the horizontal (x-error) and vertical (y-error) errors of the landing locations of the darts in relation to the centre of the target area to create a more fine-grained dependent measure (ie the mean radial error per participant) than merely collecting the number of hits and misses. This data set allows us to submit Proffitt and Linkenauger's proposal to closer inspection. More specifically, while in the original paper the results for the mean radial errors in the control condition showed a positive correlation between size perception and performance, in this paper we sought to further scrutinise Proffitt and Linkenauger's hypothesis that scaling the perceived target size to the variability in target-related performance may mediate the perceptual bias. To this end, we re-analysed the individual variability in performance by means of the standard deviations (SD) of the radial errors of each indivdual's dart throwing performance in relation to the size estimates. Note that we only analysed the data of the control condition (in which we did not induce feelings of anxiety).

To examine to what degree the variability in performance (SD) predicts the size estimates of the target, we performed a stepwise regression analysis including the SD's and the means of the radial errors as independent factors. The resulting model accounted for 22.5% of the variance of the size estimates ($F_{1,28} = 8.146$, $p = 0.008$), the SD being the only significant predictor ($\beta = -0.475$, $p = 0.008$) (see figure 2). The mean of the radial error was excluded from the model ($\beta = 0.043$, $p = 0.844$), as it did not significantly add to the predictive value of the regression.

Together, the analyses provide evidence that less variability in target-related performance in dart throwing relates to perceiving the target as being bigger, thereby providing initial support for Proffitt and Linkenauger's hypothesis. It follows that consistently getting close to the target, for example to the hole in golf putting, may lead to perceiving the target as being bigger, thereby potentially leading to better performance (see Witt et al 2012).

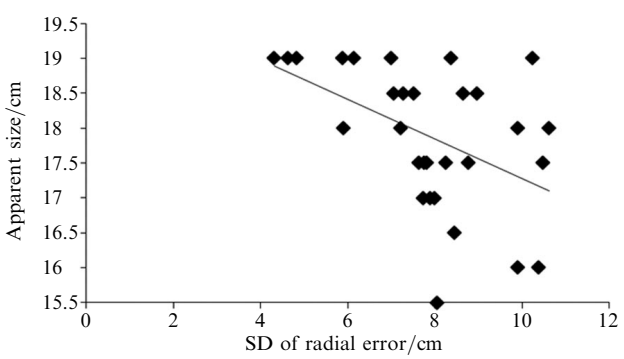

Figure 2. Dart throwing variability (ie SD of the radial error) and perceived target size. Line represents linear regression.

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